

A NEW SPECIES OF *SUAEDA* (CHENOPODIACEAE) FROM
COASTAL NORTHWESTERN SONORA, MEXICO

M. CAROLYN WATSON

Environmental Research Laboratory, The University of Arizona,
2601 E. Airport Drive, Tucson, AZ 85706

WAYNE R. FERREN, JR.

Department of Biological Sciences, University of California,
Santa Barbara, CA 93106

ABSTRACT

Suaeda puertopenascoa, a new perennial species endemic to estuarine wetlands in northwestern Sonora, Mexico, belongs to Sect. *Heterosperma*. Distinctive characteristics include opposite branches and leaves, three flowers per dichasium, perianth lobes that are fused into a basal disk with horizontal thickenings or wings, and large brown seeds averaging 2.5 mm wide. In the vicinity of Puerto Peñasco, it grows in low marsh habitats, whereas *S. esteroa* grows in upper marsh habitats and *S. moquinii* occurs along the margins of the marsh and in upland sandy habitats and saline-alkali wetlands of the adjacent desert region.

RESUMEN

Suaeda puertopenascoa, perteneciente a la Sección *Heterosperma*, es una nueva especie perenne endémica en la zona de los esteros localizados en el noroeste del estado de Sonora, México. La misma se caracteriza por tener ramas y hojas opuestas, flores tres por dicasio, lóbulos del perianto fusionados para formar un disco basal con engrosaduras o alas horizontales, y grandes semillas color café (de un promedio de 2.5 mm de ancho). En las cercanías de Puerto Peñasco, crece en las partes bajas de las marismas dentro de los esteros, mientras que *S. esteroa* crece de las partes altas de las marismas y *S. moquinii* crece en los márgenes de las marismas y en habitats arenosos y salino-alcalinios de las áreas adyacentes a la región desértica.

In 1983, while studying *Suaeda* spp. for a halophyte research program, the senior author located small-seeded and large-seeded individuals of this genus in estuarine wetlands in the vicinity of Puerto Peñasco, Mexico. We determined the small-seeded plants to belong to *Suaeda esteroa* Ferren & Whitmore, a herbaceous perennial previously reported only from estuarine wetlands along the Pacific Ocean in southern California and Baja California (Ferren and Whitmore 1983). The large-seeded individuals were determined to belong to an undescribed species apparently restricted to estuaries of coastal northwestern Sonora, which we propose here.

***Suaeda puertopenascoa* C. Watson & Ferren, sp. nov. (Fig. 1).—**
TYPE: MEXICO, Sonora, Estero Cerro Prieto, 12 km NW of
Puerto Peñasco, scattered along edge of tidal channel, S end of

estuary at southern mouth, 31°24'30"N, 113°37'W, 6 Oct 1985, *Ferren and Watson 2807* (holotype, UCSB; isotypes, ARIZ, CAS, ENCB, INIF, MEXU, MO, NY, RSA, UC, US).

Suffrutex glaber usque 110 cm alti. Caulis perennis, rami erecti vel ascendentes, increbre oppositi. Folia saepe opposita ascendentia linearia sessilia glauca decidua 3–5(–7) cm longa, 2–3 mm lata; bracteae alternae 0.5–1.5 cm longae. Flores perfecti regulares et symmetrici 2–3 mm lati, 3 in quoque dichasio, per 3 bracteolas inaequales subtenti; lobi perianthii 5 cucullati inaequales, saepe disco cuneato marginibus tumidis (incrassatis), alas basales horizontales formantes; stamina 5; stigmata 2 linearia papillosa. Calyces fructiferi 3–4(–5) mm lati. Semina monomorpha horizontalia in ovario, obtusa brunnea testa tenui, (2.0–)2.5(–3.0 mm) lata. Habitat in litoribus maritimis.

Suffruticose herb, 35 to 110 cm tall, glabrous, vegetative during first year. Stems perennial, erect to ascending, to 1 cm diameter at base, generally one from a single vertical tap root, with no obvious exfoliations; branches below inflorescence few, erect to ascending, generally opposite. Leaves frequently opposite, ascending, linear, sessile, succulent, slightly glaucous, deciduous, 3–5(–7) cm long (fresh material), 2–3 mm wide, the longer ones subtending new branches, concave adaxially to terete; margins parallel; tip acute or blunt. Inflorescence compound; dichasia axillary, sessile, alternate along erect spikes. Bracts leaf-like, alternate, 0.5–1.5 cm long and 3–4 mm wide (flowers), generally becoming yellow to yellowish-orange at maturity, deciduous. Bractlets scarious, 3, unequal; margins irregular with occasional trichomes, especially near base. Flowers perfect, bilaterally symmetrical, 2–3 mm broad, 3 per dichasium; perianth lobes 5, unequal, cucullate (hooded), rarely opening, fused at base into a swollen, often cuneate disk with marginal thickenings usually drying to form basal horizontal (transverse) wings; stamens 5; stigmas 2, linear, papillose. Fruiting calyces 3–4(–5) mm wide. Seeds monomorphic, horizontal in ovary, adherent to perianth, irregularly flattened, dull, brown, with thin membranous testa, (2.0–)2.5(–3.0) mm wide.

PARATYPES: MEXICO, Sonora, Estero las Lisas, ca. 40 km N of Puerto Peñasco, 31°36'N 113°53'W, 10 Oct 1989, *Watson 973-15* (ARIZ, UCSB); Estero Cerro Prieto, 12 km NW of Puerto Peñasco, 31°24'30"N, 113°37'W, 17 Oct 1984, *Watson 973-19, 20, 26* (ARIZ, UCSB); 6 Oct 1985, *Ferren, Watson, and Roberts 2804* (ARIZ, UCSB); Estero Cholla, 4 km NW of Puerto Peñasco, 31°20'N, 113°36'W, 1 Mar 1985, *Watson 973-28* (UCSB), 7 Oct 1985, *Ferren, Watson, and Roberts 2829* (ARIZ, UCSB); Estero de Morua, 8 km SE of Puerto Peñasco, 31°17'N, 113°28'W, 7 October 1985, *Ferren and Roberts 2833* (ARIZ, UCSB); Estero la Pinta, ca. 25 km S of

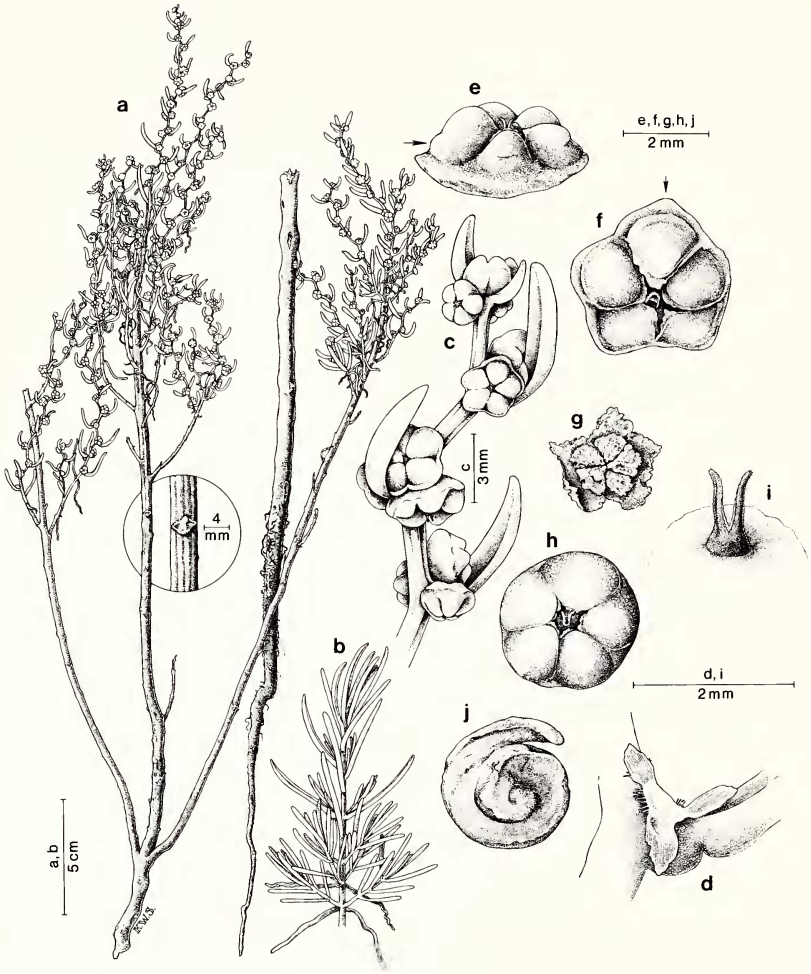


FIG. 1. *Suaeda puertopenascoa* C. Watson & Ferren. a. Habit. b. Vegetative stem. c. Portion of inflorescence. d. Bractlets and base of bract. e. Flower, fresh material, oblique view. f. Flower, fresh material, top view. g. Flower, dried material, top view. h. Flower, lower intertidal zone specimen, fresh material. i. Stigmas and crest of ovary. j. Immature seed. All illustrations are from holotype material (Ferren 2807) except b (fresh material) and h (paratype, Ferren 2804).

Puerto Peñasco, 31°16'N, 113°14'W, 9 Oct 1989, *Watson 973-12,13* (ARIZ, UCSB).

DISTRIBUTION AND HABITAT

Suaeda puertopenascoa is endemic to the northern Gulf of California and apparently is restricted to the estuaries along the northwestern coast of Sonora, where it occurs in the vicinity of Estero las Lisas, approximately 40 km N of Puerto Peñasco, and S to the vicinity of Estero la Pinto, approximately 25 km S of Puerto Peñasco. Along the northeastern gulf coast of Baja California in the vicinity of San Felipe, we have observed only *S. esteroa* in estuarine wetlands. We have no evidence that *S. puertopenascoa* occurs along the central Gulf of California from the vicinity of Bahia de Kino and southward. It appears to be restricted to estuarine wetlands northward of the occurrence of mangroves.

Suaeda puertopenascoa grows as linear groupings or scattered individuals in low marsh habitats along margins of tidal lagoons and banks of tidal channels. It colonizes open sand to silt substrates and usually occurs upslope from barren tidal flats and channel bottoms. Individuals established in lower elevations along a tidal slope are generally taller (110 versus 35 cm) and more erect in growth form than those found growing in higher elevations. It often stands taller than the frequently associated species *Batis maritima* L., *Distichlis palmeri* Fassett, *Salicornia virginica* L., and *S. bigelovii* Torr.

RELATIONSHIPS: MORPHOLOGY, PHENOLOGY, ECOLOGY

Suaeda puertopenascoa belongs to Sect. *Heterosperma* Iljin, a grouping of annuals and herbaceous perennials most frequently associated with saline and alkaline wetland habitats. This section is characterized by bilaterally symmetrical flowers, 2–3 stigmas arising directly from the top of the ovary, perianth segments often with appendages, stems which are usually not branched from the base, and seeds monomorphic or dimorphic. Species of *Suaeda* in North America that produce two distinct seed types, a dull-brown and a black-shiny type, are apparently restricted to the section. The brown seed types are relatively adherent to the perianth, light to dark brown, with a thin, membranous, testa, dull, flat to slightly plano-convex, with a prominent embryo, and generally larger than the black type. The black seed types are typically not adherent to the perianth, black to reddish-black or brown, or brownish-red, with a hard, thick testa, shiny, generally biconvex, with embryo not prominent. In North America, annuals in Sect. *Heterosperma* include *S. maritima* (L.) Dumort., *S. rolandii* Bassett & Crompton, *S. linearis* (Elliott) Moq., *S. calceoliformis* (Hook.) Moq., *S. occidentalis* Wats., *S. mexicana*

TABLE 1. COMPARISONS OF SELECTED CHARACTERS OF *SUAEDA ESTEROA* AND *SUAEDA PUERTOPENASCOA* IN SONORA, MEXICO. ¹ = fresh specimens. ² = range, mean and sample number were based on measurements of vegetative fresh specimens collected during January, 1989 and 1990.

Character	<i>S. esteroa</i>	<i>S. puertopenascoa</i>
Stature ¹ , cm	(15-)25-45(-60)	(35-)45-90(-110)
Branches and leaves arrangement	alternate	usually opposite
Leaf length ² , cm		
Subtending leaves	2.5-4.1, \bar{x} = 3.2 (n = 75)	3.0-6.8, \bar{x} = 4.8 (n = 75)
Branch leaves	2.0-3.3, \bar{x} = 2.6 (n = 95)	2.5-5.0, \bar{x} = 3.7 (n = 90)
Inflorescence	densely clustered	loosely spaced
No. flowers/dichasium	(3-)5-6(-8)	invariably 3
Fruiting calyx width ¹ , mm	2-3	3-4(-5)
Calyx lobes	without pronounced basal horizontal wings	with pronounced basal horizontal wings
Seed type	dimorphic	monomorphic
Seed width, mm	brown (1.2-)1.7(-2.0) black (1.0-)1.1(-1.2)	brown (2.0-)2.5(3.0)

(Standley) Standley and *S. jacoensis* I. M. Johnston (Hopkins and Blackwell 1977; Bassett and Crompton 1978).

Suaeda puertopenascoa appears most closely related to *S. esteroa*, the only other perennial North American species of the section. They are sympatric in estuaries of coastal northwestern Sonora but can be distinguished by ecological, morphological and phenological characteristics. *Suaeda puertopenascoa* is restricted to the low marsh zones and *S. esteroa* commonly occupies the middle to high marsh zones.

Morphological characters that can consistently be used to distinguish *S. puertopenascoa* from *S. esteroa* are listed in Table 1. Vegetatively, the most striking differences between the species are in stature, leaf length, and branch and leaf arrangement. *Suaeda puertopenascoa* is generally taller in height than *S. esteroa*, with the largest plants of both taxa being displayed in the lower-most limits of their distribution. Even though leaf size and degree of succulence appears to be variable with age and environmental extremes, in both species the subtending leaves to developing axillary branches are always larger than the leaves of branches. Average leaf length, however, is consistently longer in *S. puertopenascoa* than in *S. esteroa*. The distinguishing feature of opposite leaves in *S. puertopenascoa* is otherwise found only in *S. jacoensis*, an annual species endemic to western Coahuila, Mexico.

Reproductive characters that generally distinguish *S. puertopenascoa* from *S. esteroa* are a more loose or open inflorescence, with



FIG. 2. Habitats of *Suaeda* spp. in estuarine wetlands in the vicinity of Puerto Peñasco, Sonora, Mexico. A. *S. puertopenascoa*, low marsh zone. B. *S. esteroa*, middle marsh zone. C. *S. moquini*, along margins of estuary.

flowers typically not congested and clusters distant, the consistent production of three flowers per dichasium, and larger fruit and seed sizes. We have never observed the black seed type in *S. puertopenascoa*. In the vicinity of Puerto Peñasco, we observed that *S. esteroa* predominantly produces the brown seed type that is consistently smaller than that of *S. puertopenascoa*, and rarely produces the black seed type in this region. Along the southern California estuarine wetlands, both seed types have been observed in *S. esteroa* plants, with the black seed type described by Ferren and Whitmore (1983). Bassett and Crompton (1978) have used seed characters as one of the morphological features to distinguish between two annual species in Canada. Likewise, seed type and size appear to be important diagnostic characters to distinguish between perennial taxon in Mexico.

Field observations and experimental field plantings at Puerto Peñasco reveal that *S. puertopenascoa* remains vegetative the first year after germination and does not flower until the second year, whereas *S. esteroa* flowers during the first growing season and then may die in some habitats or persist in others. Anthesis and seed maturation in populations of *S. puertopenascoa* appear to be more seasonally limited than that of *S. esteroa*. *Suaeda puertopenascoa* initiates flow-

ering in early summer (June) and produces mature seed during late fall (October through November). In the vicinity of Puerto Peñasco, *S. esteroa* generally initiates flowering in mid-summer (July) and seed reaches maturity from late fall through winter (October through December) and occasionally through early spring (March). As seed maturity is reached, leaves and calyces of *S. puertopenascoa* turn yellow to yellowish-orange and become deciduous in late fall, generally before new vegetative material is produced; whereas those of *S. esteroa* often turn yellow to red or burgundy and can persist through winter during the same time that new vegetative portions are produced.

In general, species of *Suaeda* occupy different portions of the upland to low marsh gradient along the tidal shores of estuaries of northwestern Sonora (Fig. 2). Coastal desert scrub, dunes, saline-alkali wetlands and upper margins of estuaries are often characterized by the shrub *S. moquinii* (Torrey) E. Greene, which belongs to Sect. *Limbogermen* Iljin. Upper marsh habitats often support scattered individuals or small clusters of *S. esteroa*, which rarely occupies the lower marsh zones. Lower marsh habitats often support scattered individuals or linear clusters of *S. puertopenascoa*. There are no available data to suggest that *S. puertopenascoa* and *S. esteroa* are interfertile.

ACKNOWLEDGMENTS

We thank the Secretaría de Desarrollo Urbano y Ecología for a permit to collect plants in Mexico and the Centro Intercultural de Estudios de Desiertos y Océanos for accommodations in Mexico. We also thank Fred Roberts and Fernando Martinez for assistance with field work, Kathryn Simpson for the illustration, and Jim Henrickson, Richard Felger, three reviewers and the Editor for many helpful comments. The Environmental Research Laboratory of The University of Arizona, Tucson and The Herbarium of the University of California, Santa Barbara, provided financial support.

LITERATURE CITED

- BASSETT, I. J. and C. W. CROMPTON. 1978. The genus *Suaeda* (Chenopodiaceae) in Canada. *Canad. J. Bot.* 56:581-591.
- FERREN, W. R., JR. and S. A. WHITMORE. 1983. *Suaeda esteroa* (Chenopodiaceae), a new species from estuaries of southern California and Baja California. *Madroño* 30:181-190.
- HOPKINS, C. O. and W. H. BLACKWELL, JR. 1977. Synopsis of *Suaeda* (Chenopodiaceae) in North America. *Sida* 7:147-173.

(Received 6 Feb 1990; revision accepted 12 Oct 1990.)